

## Claims

- [c1] 1. An integrated circuit for providing drive signals to a piezo element of a milli-actuator device in a mass data storage device, comprising:  
a first circuit for receiving head position control signals and for providing a charging current to a sense capacitor in response thereto;  
wherein said first circuit is powered by a voltage supply that is referenced to a substrate potential; and  
a second circuit for mirroring a current in said first circuit at a predetermined mirror ratio to provide drive currents to said piezo element.
- [c2] 2. The integrated circuit of claim 1 wherein said substrate potential is an analog ground potential.
- [c3] 3. The integrated circuit of claim 1 wherein said voltage supply is a voltage supply other than a voltage supply for said piezo element.
- [c4] 4. The integrated circuit of claim 1 wherein said predetermined mirror ratio is 10:1.
- [c5] 5. The integrated circuit of claim 1 wherein said predetermined mirror ratio is 6.125:1.
- [c6] 6. The integrated circuit of claim 1 further comprising:  
a first switch connected to selectively disable said first circuit;  
a second switch connected to selectively provide a feedback path from said second circuit to an input of said second circuit;  
wherein when said first and second switches are selectively operated, said integrated circuit operates in a voltage mode.
- [c7] 7. The integrated circuit of claim 1 further comprising servo circuitry integrated therewith.
- [c8] 8. A milli-actuator driver for positioning a head of a hard disk drive, comprising:  
first integrated circuit means for receiving head position control signals and for

providing a charging current to an external sense capacitor in response thereto;  
 wherein said first integrated circuit means is powered by a voltage supply that is  
 referenced to a substrate potential; and  
 second integrated circuit means for mirroring a current in said first integrated  
 circuit means at a predetermined mirror ratio to provide drive currents to a  
 piezo element.

- [c9] 9. The milli-actuator driver of claim 8 wherein said substrate potential is an  
 analog ground potential.
- [c10] 10. The milli-actuator driver of claim 8 wherein said voltage supply is a voltage  
 supply other than a voltage supply for said piezo element.
- [c11] 11. The milli-actuator driver of claim 8 wherein said predetermined mirror ratio  
 is 10:1.
- [c12] 12. The milli-actuator driver of claim 8 wherein said predetermined mirror ratio  
 is 6.125:1.
- [c13] 13. The milli-actuator driver of claim 8 further comprising:  
 a first switch connected to selectively disable said first integrated circuit; means  
 a second switch connected to selectively provide a feedback path from said  
 second integrated circuit means to an input of said second integrated circuit;  
 means  
 wherein when said first and second switches are selectively operated, said  
 integrated circuit operate sin a voltage mode.
- [c14] 14. The milli-actuator driver of claim 8 further comprising servo circuitry  
 integrated therewith.
- [c15] 15. An integrated circuit for providing drive signals to a piezo element of a  
 milli-actuator device in a mass data storage device to position a data head  
 thereof, comprising:  
 a current mirror;  
 said current mirror comprising:

a first current mirror portion;  
said first current mirror portion being configured to receive head position control signals from a head position sensing circuit;  
said first current mirror portion being configured to provide a first current in response to said head position control signals for connection to a capacitor;  
said first mirror portion being powered by a voltage supply that is referenced to a substrate potential;  
a second current mirror portion;  
said second current mirror portion being configured to mirror said first current at a predetermined mirror ratio; and  
said second current mirror being configured to provide drive currents for connection to said piezo element.

- [c16] 16. The integrated circuit of claim 15 wherein said substrate potential is an analog ground potential.
- [c17] 17. The integrated circuit of claim 15 wherein said voltage supply is a voltage supply other than a voltage supply for said piezo element.
- [c18] 18. The integrated circuit of claim 15 wherein said predetermined mirror ratio is 10:1.
- [c19] 19. The integrated circuit of claim 15 wherein said predetermined mirror ratio is 6.125:1.
- [c20] 20. The integrated circuit of claim 15 further comprising:  
a first switch connected to selectively disable said first current mirror portion  
a second switch connected to selectively provide a feedback path from said second current mirror portion o an input of said second current mirror portion  
wherein when said first and second switches are selectively operated, said integrated circuit operate sin a voltage mode.
- [c21] 21. The integrated circuit of claim 15 further comprising servo circuitry integrated therewith.

- [c22] 22. A method for operating a milli-actuator driver for a mass data storage device, comprising:  
 providing a current mirror having first and second current outputs,  
 wherein said first and second current outputs have a ratio of  $1X:nX$ ;  
 wherein said first current output is adapted to be connected to a capacitor;  
 wherein said second current output is adapted to be connected to a piezo element of milli-actuator; of said mass data storage device  
 providing a supply voltage to at least a first portion of said current mirror that is referenced to a ground voltage.
- [c23] 23. The method of claim 22 wherein said ground voltage is a substrate potential.
- [c24] 24. The method of claim 22 further comprising configuring said current mirror to have a  $1X:nX$  ratio of 1:10.
- [c25] 25. The method of claim 22 further comprising configuring said current mirror to have a  $1X:nX$  ratio of 1:6.125.
- [c26] 26. The method of claim 22 further comprising:  
 providing a first switch connected to selectively disable said first current output of said current mirror.  
 providing a second switch connected to selectively provide a feedback path for said second current output of said current mirror.  
 wherein when said first and second switches are selectively operated, said milli-actuator driver operates in a voltage mode.